FG88 ⓘ

FIG. 1

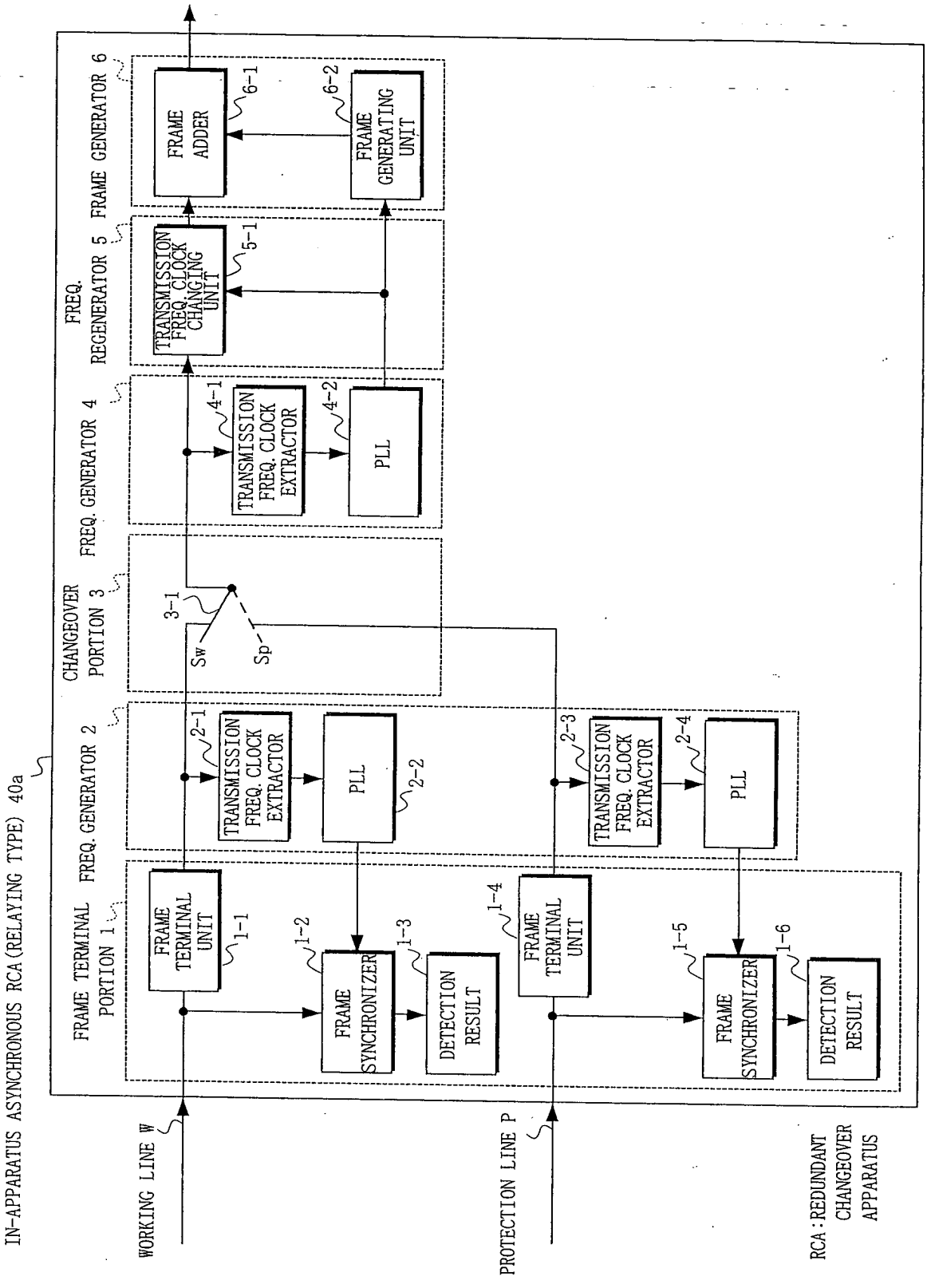

IN-APPARATUS ASYNCHRONOUS RCA (RELAYING TYPE) 40a
FRAME TERMINAL PORTION 1
FREQ. GENERATOR 2
CHANGEOVER PORTION 3
FREQ. GENERATOR 4
FREQ. REGENERATOR 5
FRAME GENERATOR 6
FRAME TERMINAL UNIT
1-1
1-2
FRAME SYNCHRONIZER
1-3
DETECTION RESULT
1-4
FRAME TERMINAL UNIT
1-5
FRAME SYNCHRONIZER
1-6
DETECTION RESULT
2-1
TRANSMISSION FREQ. CLOCK EXTRACTOR
PLL
2-2
2-3
TRANSMISSION FREQ. CLOCK EXTRACTOR
2-4
PLL
3-1
Sw
Sp
4-1
TRANSMISSION FREQ. CLOCK EXTRACTOR
4-2
PLL
TRANSMISSION FREQ. CLOCK CHANGING UNIT
5-1
FRAME ADDER
6-1
FRAME GENERATING UNIT
6-2
WORKING LINE W
PROTECTION LINE P
RCA : REDUNDANT CHANGEOVER APPARATUS

FIG. 2A

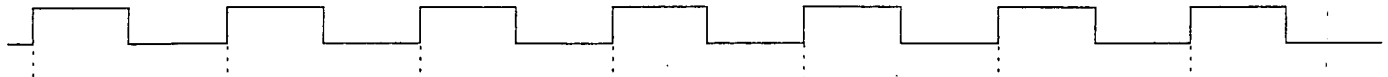


FIG. 2B

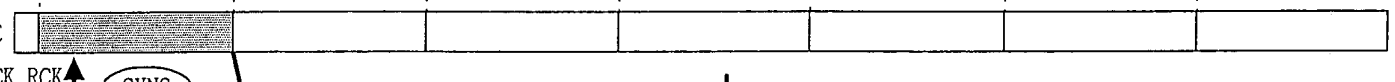


FIG. 2C

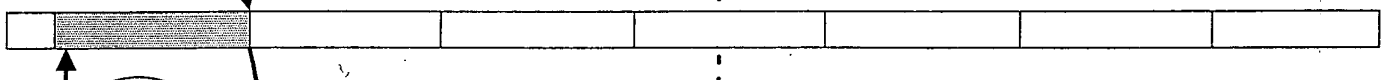


FIG. 2D

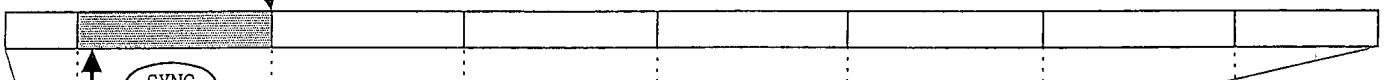


FIG. 2E

FIG. 2F

FIG. 3

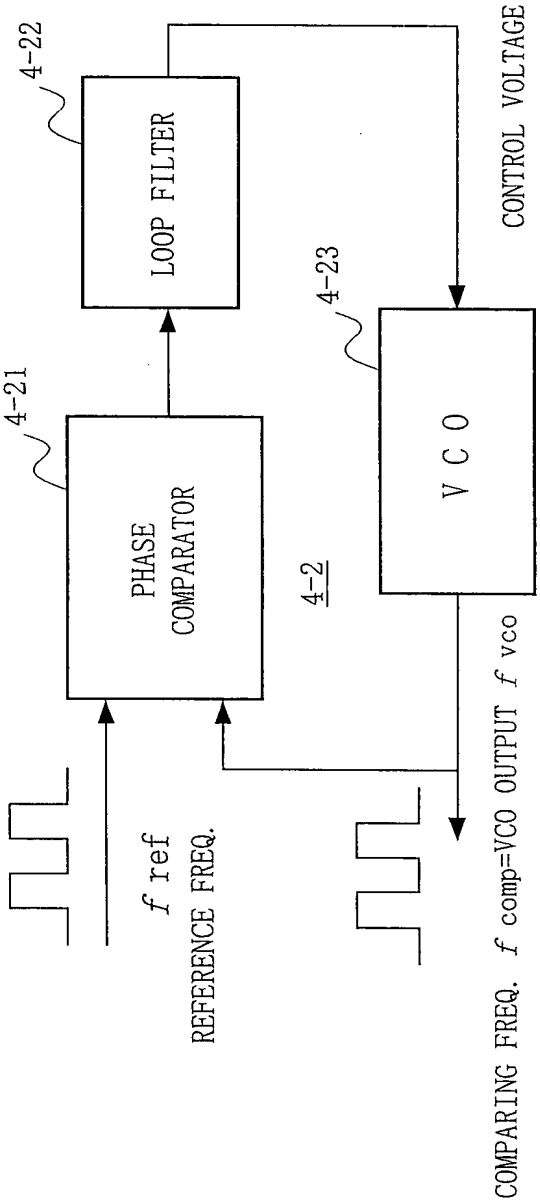
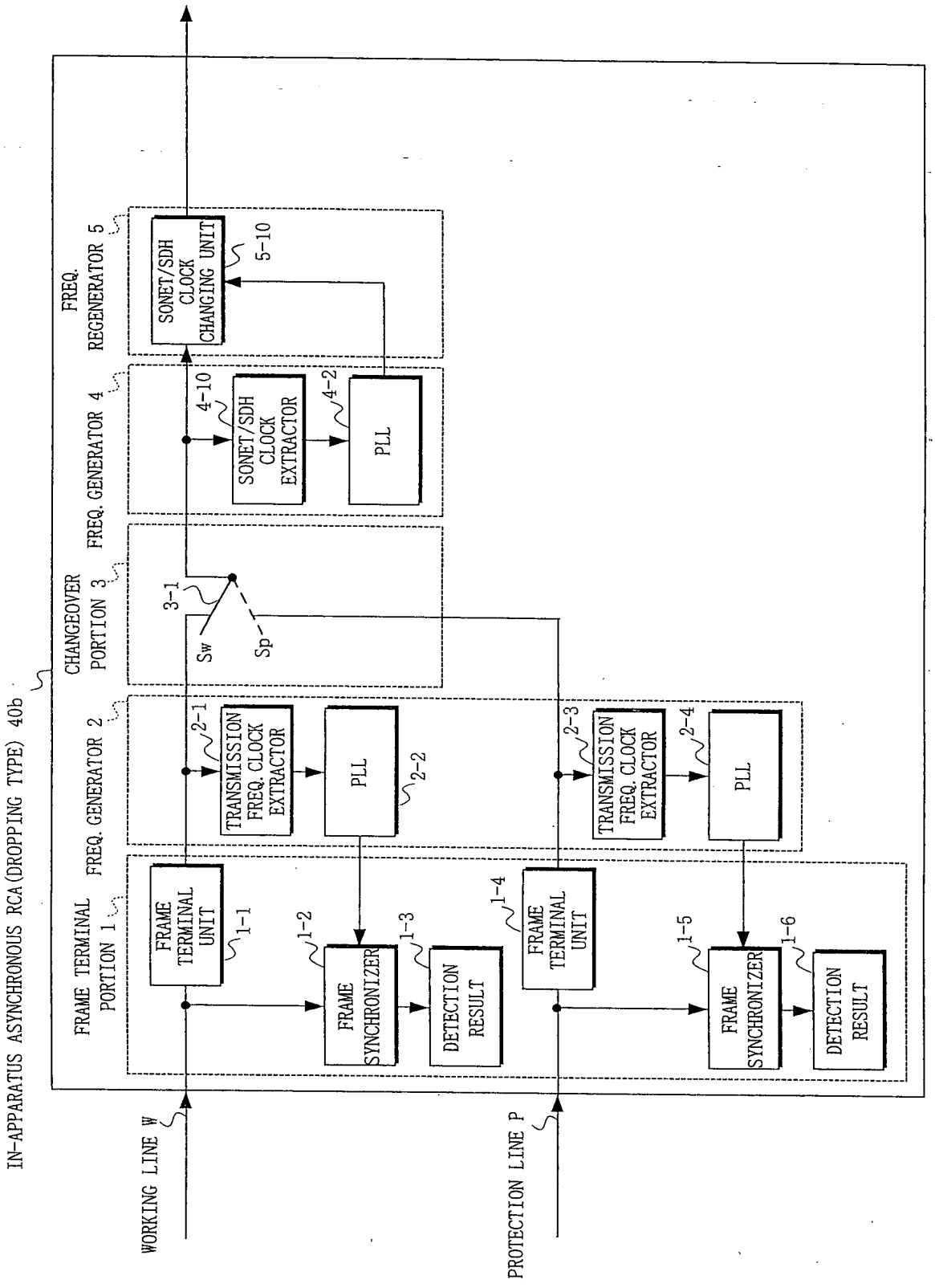
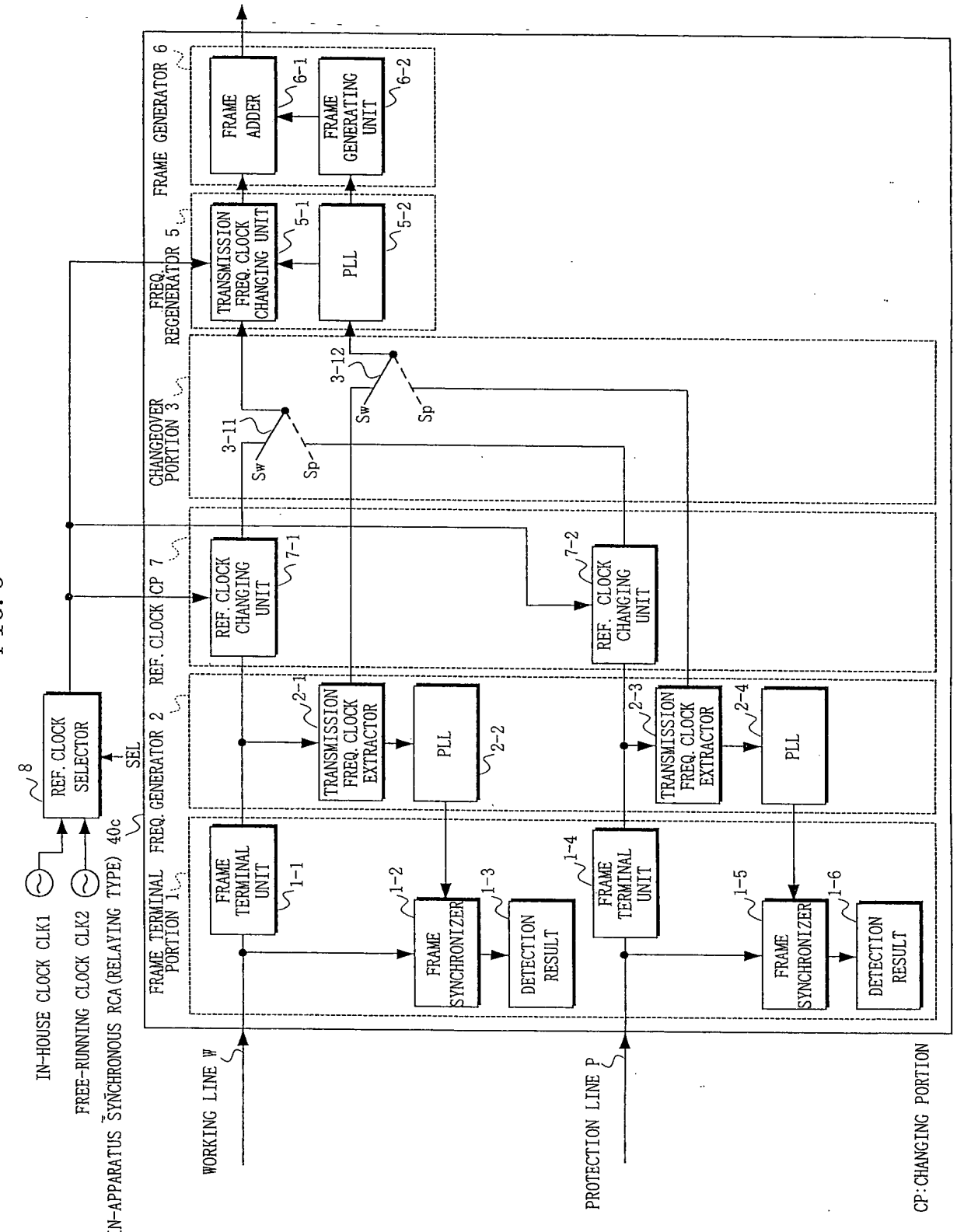

4-22
LOOP FILTER
CONTROL VOLTAGE
4-23
4-21
PHASE COMPARATOR
V C O
4-2
f ref
REFERENCE FREQ.
COMPARING FREQ. f comp=VCO OUTPUT f vco

FIG. 4


IN-APPARATUS ASYNCHRONOUS RCA(DROPPING TYPE) 40b
FRAME TERMINAL PORTION 1
FREQ. GENERATOR 2
CHANGEOVER PORTION 3
FREQ. GENERATOR 4
FREQ. REGENERATOR 5
WORKING LINE W
PROTECTION LINE P
FRAME TERMINAL UNIT
1-1
FRAME SYNCHRONIZER
1-2
DETECTION RESULT
1-3
FRAME TERMINAL UNIT
1-4
FRAME SYNCHRONIZER
1-5
DETECTION RESULT
1-6
TRANSMISSION FREQ. CLOCK EXTRACTOR
2-1
PLL
2-2
TRANSMISSION FREQ. CLOCK EXTRACTOR
2-3
PLL
2-4
Sw
Sp
3-1
SONET/SDH CLOCK EXTRACTOR
4-10
PLL
4-2
SONET/SDH CLOCK CHANGING UNIT
5-10

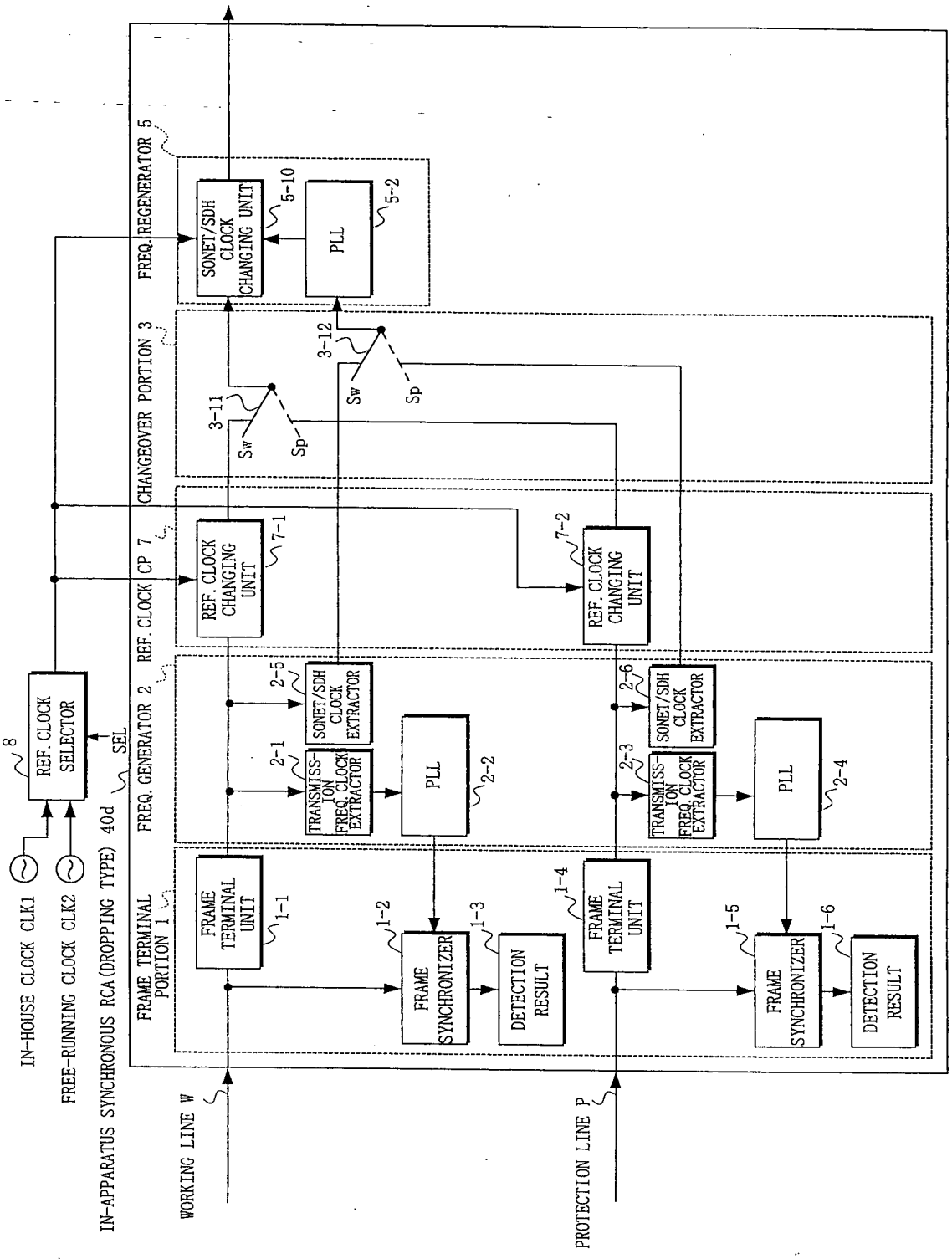
FG88 (5)

FIG. 5


IN-HOUSE CLOCK CLK1
FREE-RUNNING CLOCK CLK2
IN-APPARATUS SYNCHRONOUS RCA (RELAYING TYPE) 40c
8
REF. CLOCK SELECTOR
SEL
FRAME TERMINAL PORTION 1
FREQ. GENERATOR 2
REF. CLOCK CP 7
CHANGEOVER PORTION 3
FREQ. REGENERATOR 5
FRAME GENERATOR 6
FRAME TERMINAL UNIT
1-1
TRANSMISSION FREQ. CLOCK EXTRACTOR
2-1
PLL
2-2
REF. CLOCK CHANGING UNIT
7-1
3-11
Sw
Sp
3-12
TRANSMISSION FREQ. CLOCK CHANGING UNIT
5-1
PLL
5-2
FRAME ADDER
6-1
FRAME GENERATING UNIT
6-2
FRAME SYNCHRONIZER
1-2
DETECTION RESULT
1-3
FRAME TERMINAL UNIT
1-4
TRANSMISSION FREQ. CLOCK EXTRACTOR
2-3
PLL
2-4
REF. CLOCK CHANGING UNIT
7-2
FRAME SYNCHRONIZER
1-5
DETECTION RESULT
1-6
WORKING LINE W
PROTECTION LINE P
CP: CHANGING PORTION

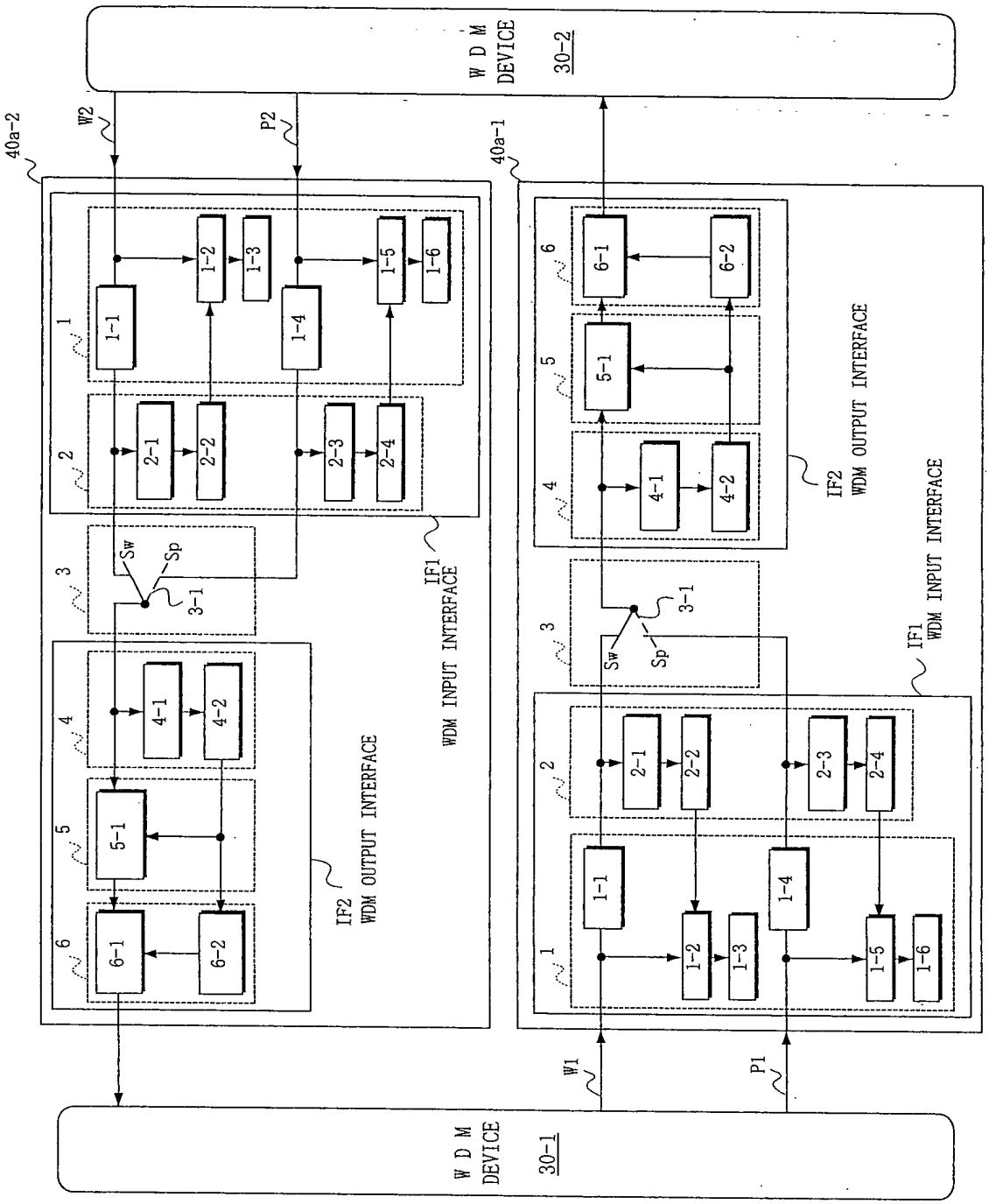
FG88 (b)

FIG. 6


IN-HOUSE CLOCK CLK1
FREE-RUNNING CLOCK CLK2
IN-APPARATUS SYNCHRONOUS RCA(DROPPING TYPE) 40d
8
REF. CLOCK SELECTOR
SEL
FRAME TERMINAL PORTION 1
FREQ. GENERATOR 2
REF. CLOCK CP 7
CHANGEOVER PORTION 3
FREQ. REGENERATOR 5
WORKING LINE W
PROTECTION LINE P
FRAME TERMINAL UNIT
1-1
1-4
FRAME SYNCHRONIZER
1-2
1-5
DETECTION RESULT
1-3
1-6
TRANSMISSION FREQ. CLOCK EXTRACTOR
2-1
2-3
SONET/SDH CLOCK EXTRACTOR
2-5
2-6
PLL
2-2
2-4
REF. CLOCK CHANGING UNIT
7-1
7-2
3-11
3-12
Sw
Sp
SONET/SDH CLOCK CHANGING UNIT
5-10
PLL
5-2

FG88 ⑦

FIG. 7


W D M DEVICE
30-2
W2
P2
40a-2
40a-1
IF1 WDM INPUT INTERFACE
IF2 WDM OUTPUT INTERFACE
Sw
Sp
3-1
1-1
1-2
1-3
1-4
1-5
1-6
2-1
2-2
2-3
2-4
4-1
4-2
5-1
6-1
6-2
W1
P1
W D M DEVICE
30-1

FG88 (8)

FIG. 8

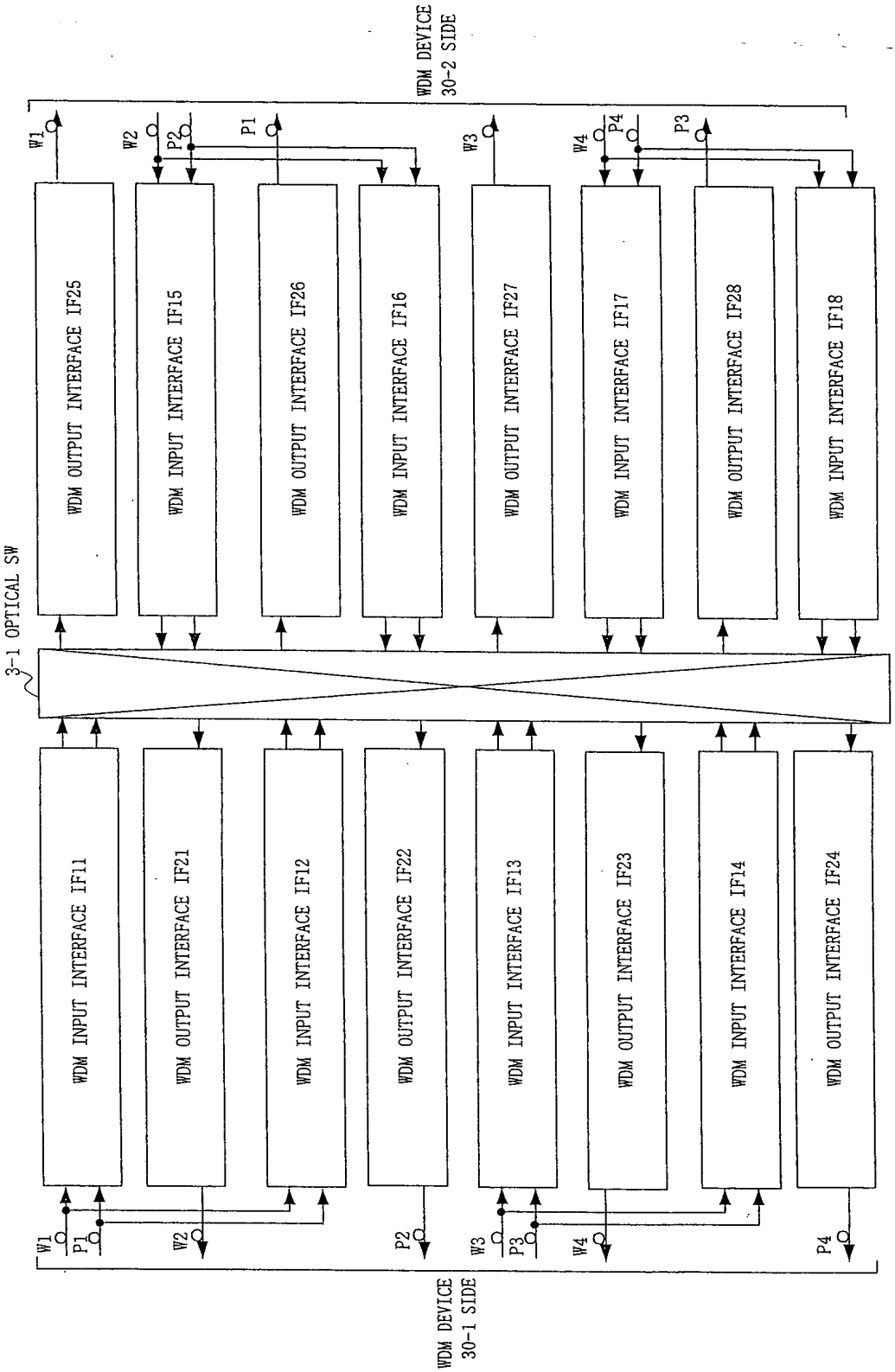

WDM DEVICE
30-2 SIDE
W1
W2
P2
P1
W3
W4
P4
P3
WDM OUTPUT INTERFACE IF25
WDM INPUT INTERFACE IF15
WDM OUTPUT INTERFACE IF26
WDM INPUT INTERFACE IF16
WDM OUTPUT INTERFACE IF27
WDM INPUT INTERFACE IF17
WDM OUTPUT INTERFACE IF28
WDM INPUT INTERFACE IF18
3-1 OPTICAL SW
WDM INPUT INTERFACE IF11
WDM OUTPUT INTERFACE IF21
WDM INPUT INTERFACE IF12
WDM OUTPUT INTERFACE IF22
WDM INPUT INTERFACE IF13
WDM OUTPUT INTERFACE IF23
WDM INPUT INTERFACE IF14
WDM OUTPUT INTERFACE IF24
W1
P1
W2
P2
W3
P3
W4
P4
WDM DEVICE
30-1 SIDE

FIG. 9

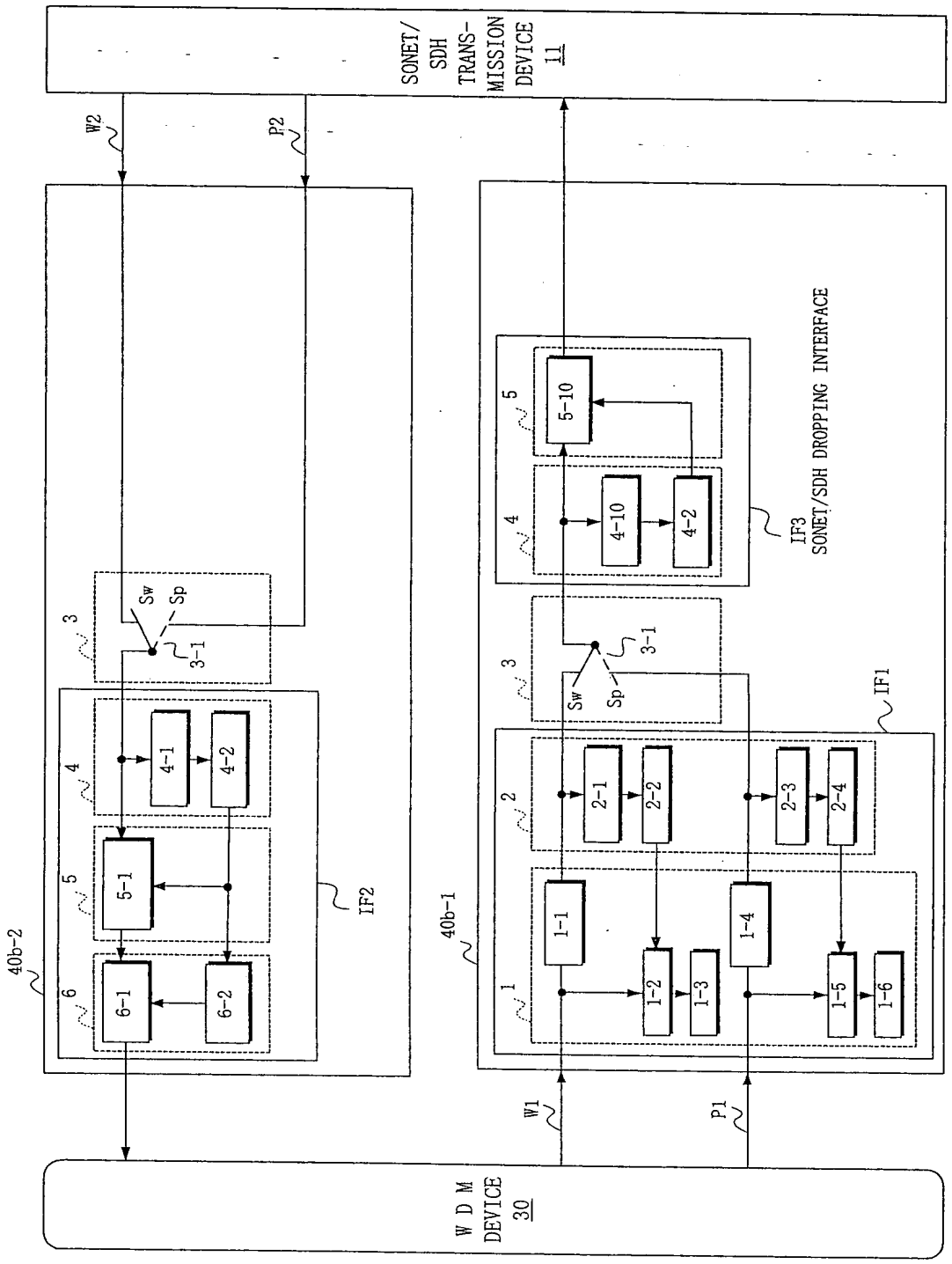
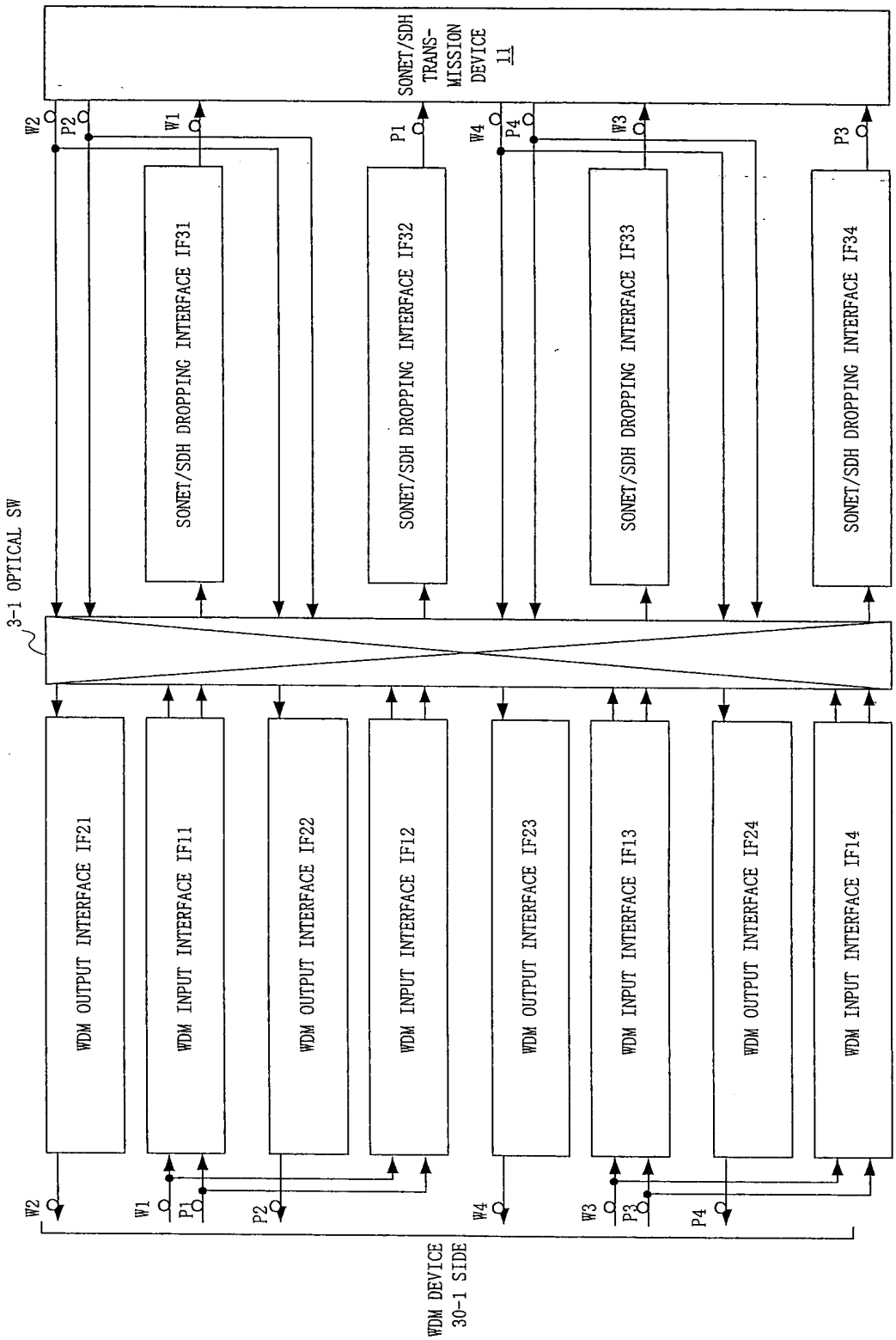

SONET/
SDH
TRANS-
MISSION
DEVICE
11
W2
P2
W1
P1
W D M
DEVICE
30
40b-1
40b-2
IF1
IF2
IF3
SONET/SDH DROPPING INTERFACE
Sw
Sp
3-1
1-1
1-2
1-3
1-4
1-5
1-6
2-1
2-2
2-3
2-4
4-1
4-2
4-10
5-1
5-10
6-1
6-2

FIG. 10


SONET/SDH TRANS-MISSION DEVICE 11
W2
P2
W1
P1
W4
P4
W3
P3
SONET/SDH DROPPING INTERFACE IF31
SONET/SDH DROPPING INTERFACE IF32
SONET/SDH DROPPING INTERFACE IF33
SONET/SDH DROPPING INTERFACE IF34
3-1 OPTICAL SW
WDM OUTPUT INTERFACE IF21
WDM INPUT INTERFACE IF11
WDM OUTPUT INTERFACE IF22
WDM INPUT INTERFACE IF12
WDM OUTPUT INTERFACE IF23
WDM INPUT INTERFACE IF13
WDM OUTPUT INTERFACE IF24
WDM INPUT INTERFACE IF14
W2
W1
P1
P2
W4
W3
P3
P4
WDM DEVICE 30-1 SIDE

FG88 ⑪

FIG. 11

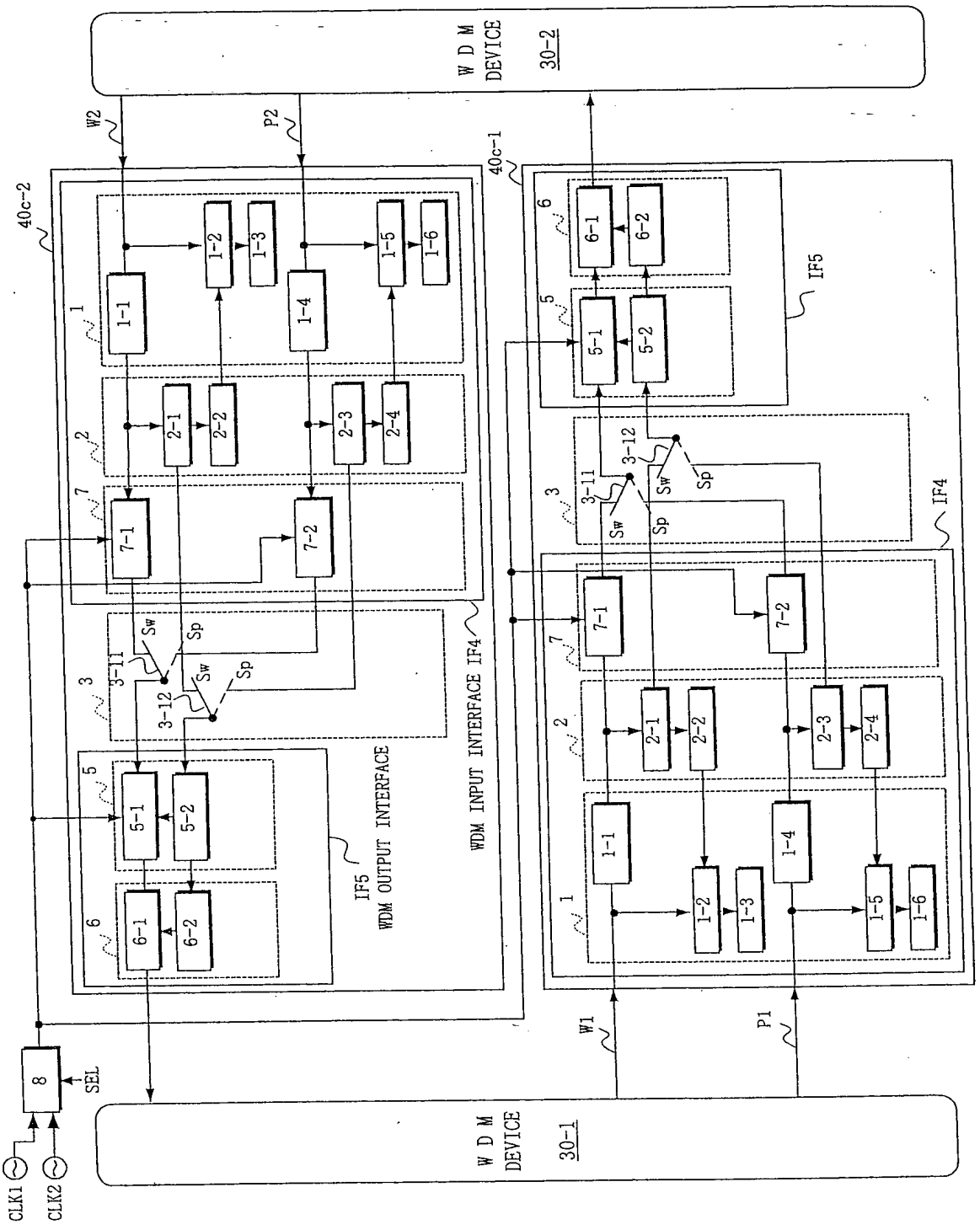
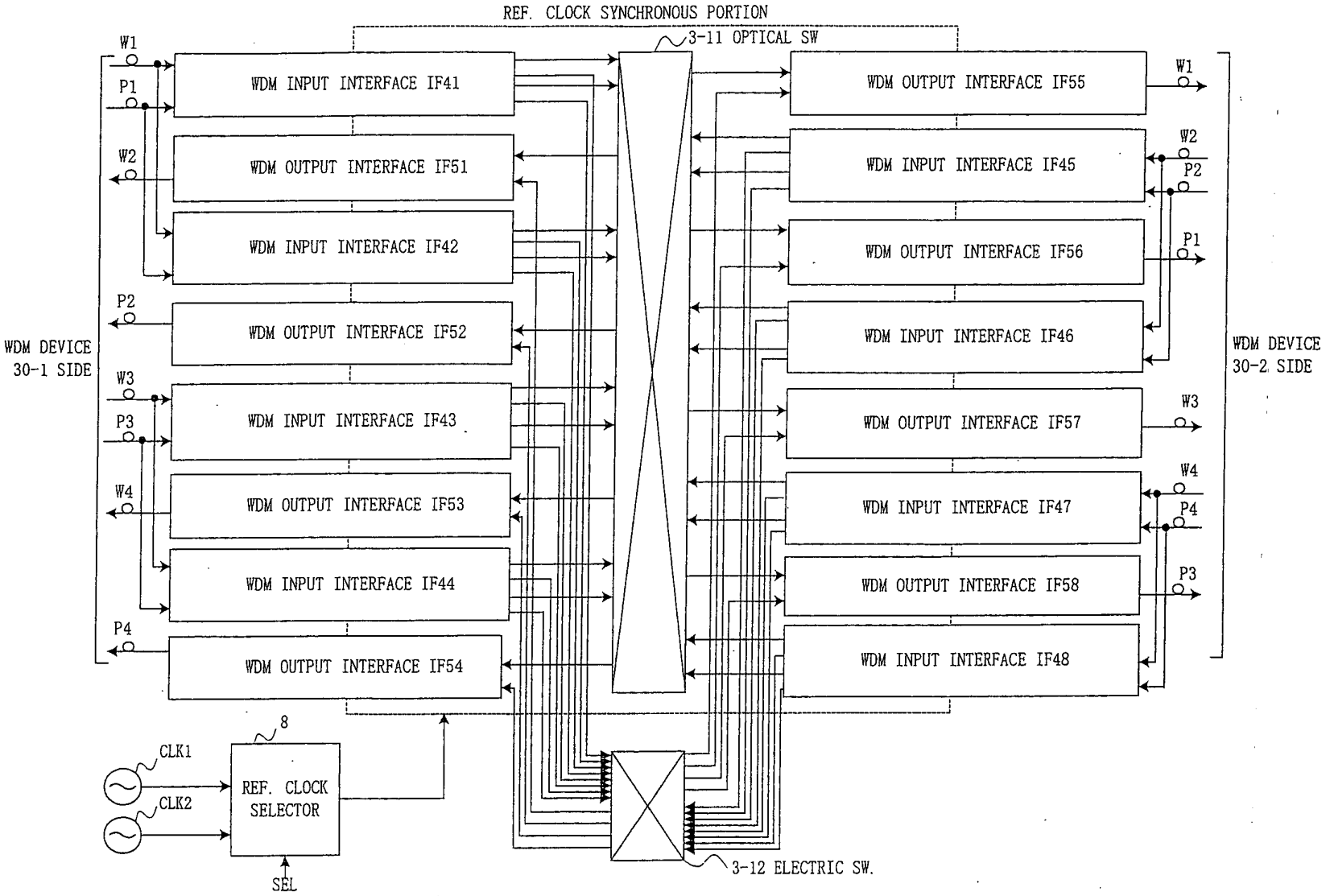

W D M DEVICE 30-2
W2
P2
40c-2
40c-1
WDM INPUT INTERFACE IF4
WDM OUTPUT INTERFACE IF5
IF5
IF4
1-1
1-2
1-3
1-4
1-5
1-6
2-1
2-2
2-3
2-4
3-11
3-12
Sw
Sp
5-1
5-2
6-1
6-2
7-1
7-2
8
SEL
CLK1
CLK2
W1
P1
W D M DEVICE 30-1

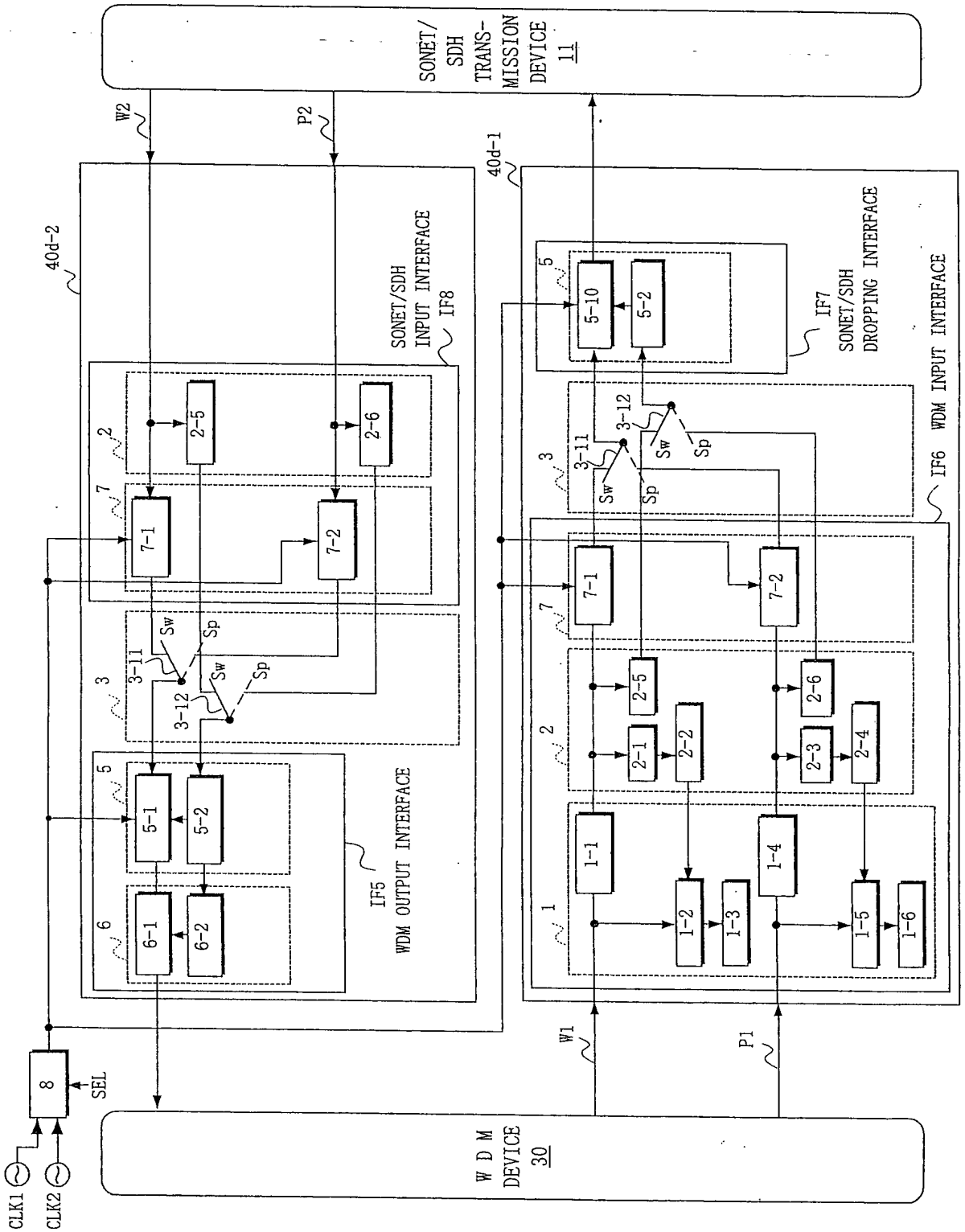
FIG. 12



FG88 (12)

FG88 (13)

FIG. 13



FG88

FIG. 14

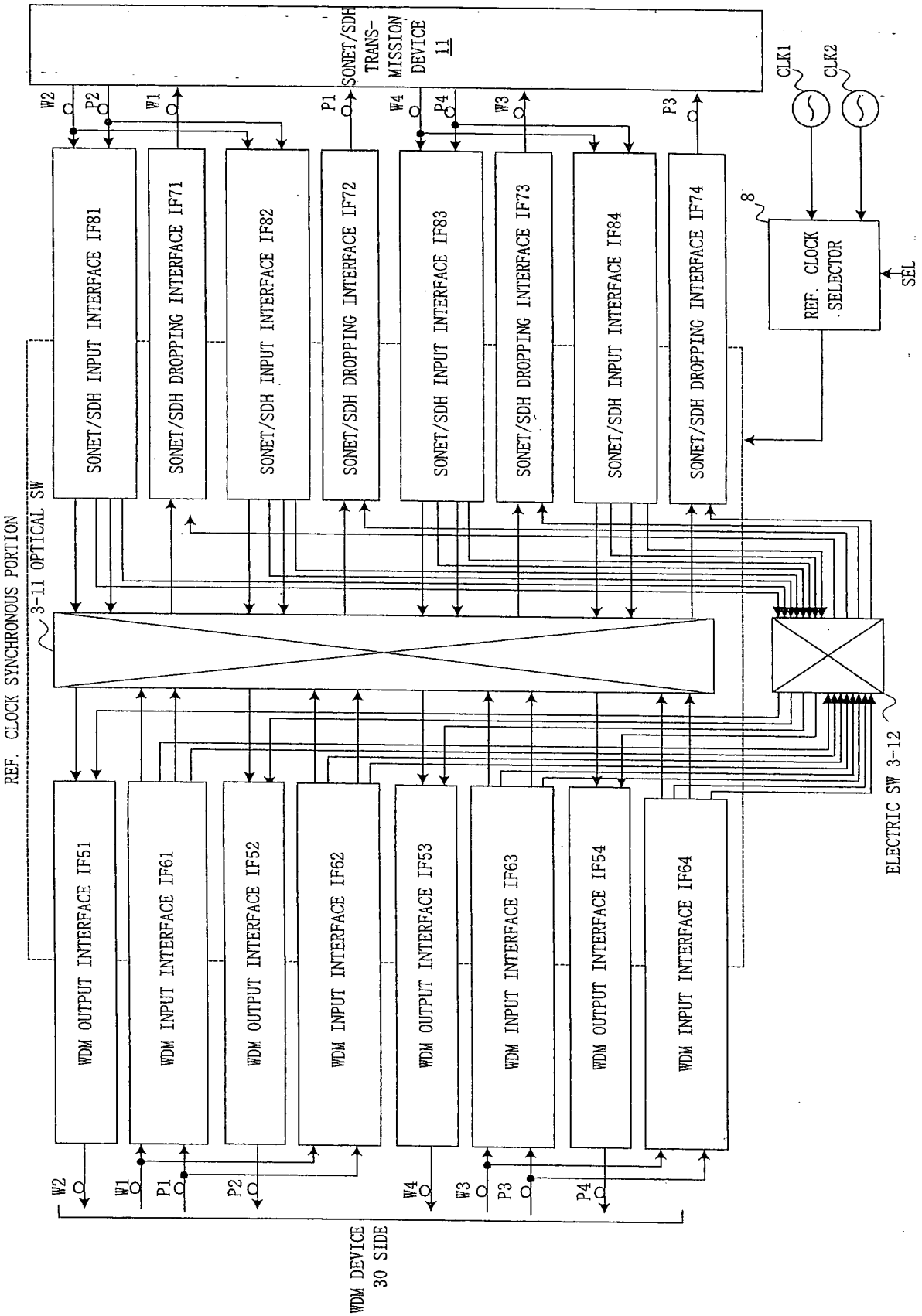
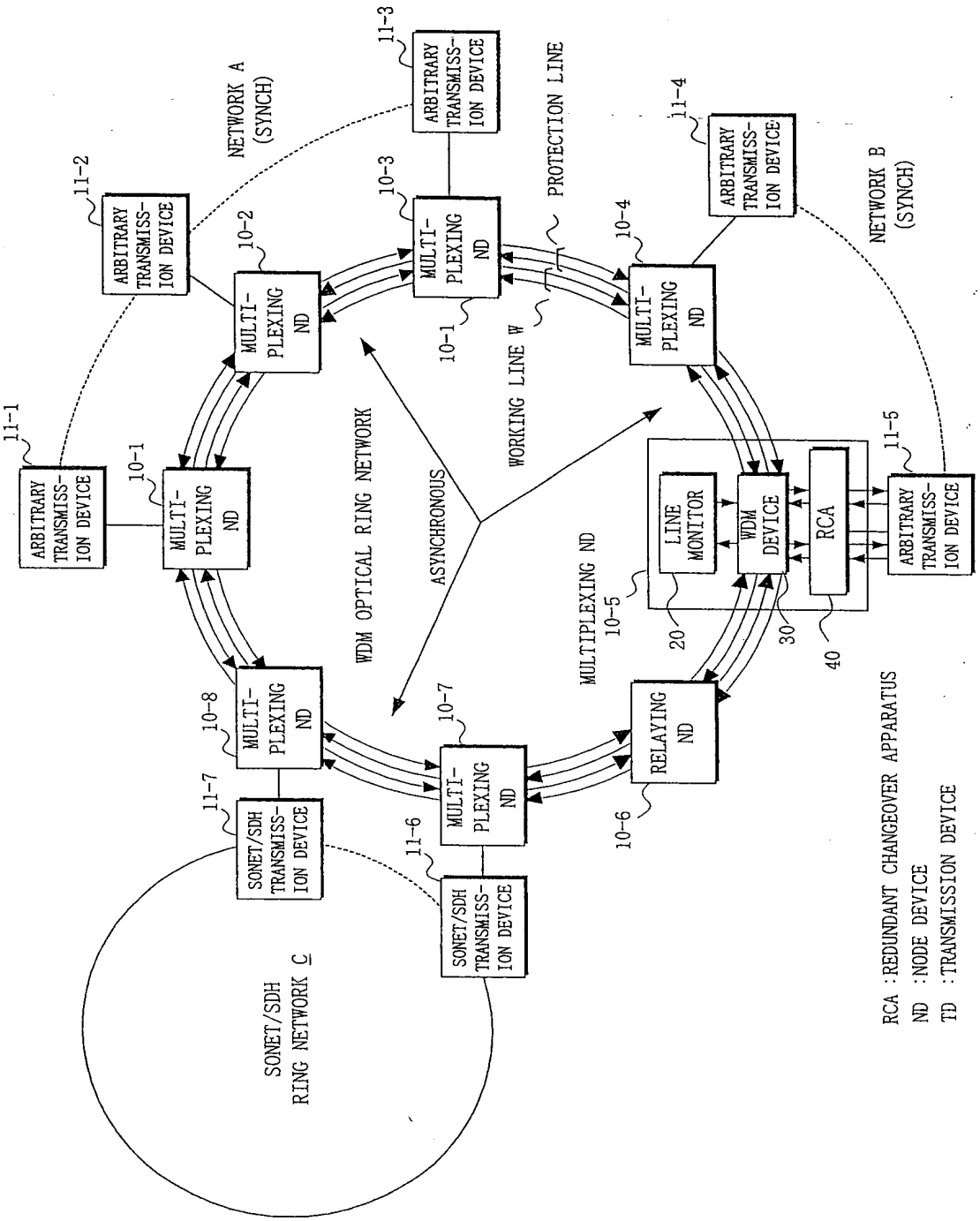

SONET/SDH TRANS-MISSION DEVICE 11
W2
P2
W1
P1
W4
P4
W3
P3
CLK1
CLK2
8
REF. CLOCK SELECTOR
SEL
SONET/SDH INPUT INTERFACE IF81
SONET/SDH DROPPING INTERFACE IF71
SONET/SDH INPUT INTERFACE IF82
SONET/SDH DROPPING INTERFACE IF72
SONET/SDH INPUT INTERFACE IF83
SONET/SDH DROPPING INTERFACE IF73
SONET/SDH INPUT INTERFACE IF84
SONET/SDH DROPPING INTERFACE IF74
REF. CLOCK SYNCHRONOUS PORTION
3-11 OPTICAL SW
ELECTRIC SW 3-12
WDM OUTPUT INTERFACE IF51
WDM INPUT INTERFACE IF61
WDM OUTPUT INTERFACE IF52
WDM INPUT INTERFACE IF62
WDM OUTPUT INTERFACE IF53
WDM INPUT INTERFACE IF63
WDM OUTPUT INTERFACE IF54
WDM INPUT INTERFACE IF64
W2
W1
P1
P2
W4
W3
P3
P4
WDM DEVICE 30 SIDE

FIG. 15


NETWORK A (SYNCH)
NETWORK B (SYNCH)
PROTECTION LINE
WORKING LINE W
WDM OPTICAL RING NETWORK
ASYNCHRONOUS
MULTIPLEXING ND
SONET/SDH RING NETWORK C
ARBITRARY TRANSMISSION DEVICE
MULTI-PLEXING ND
RELAYING ND
LINE MONITOR
WDM DEVICE
RCA
SONET/SDH TRANSMISSION DEVICE
RCA : REDUNDANT CHANGEOVER APPARATUS
ND : NODE DEVICE
TD : TRANSMISSION DEVICE

FG88 (16)

FIG. 16
PRIOR ART

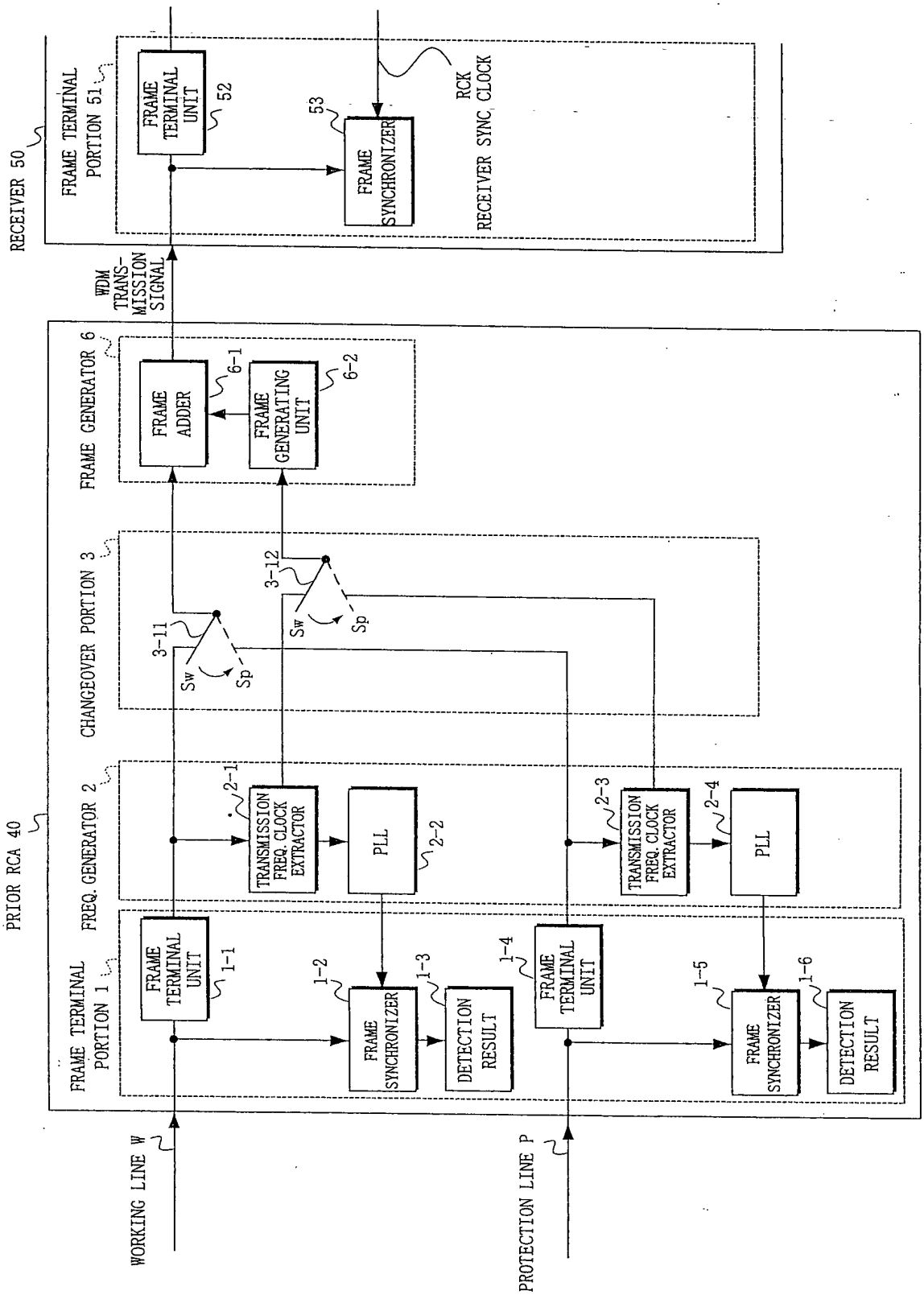


FIG. 17A

FIG. 17B

FIG. 17C

FIG. 17D

FIG. 17E

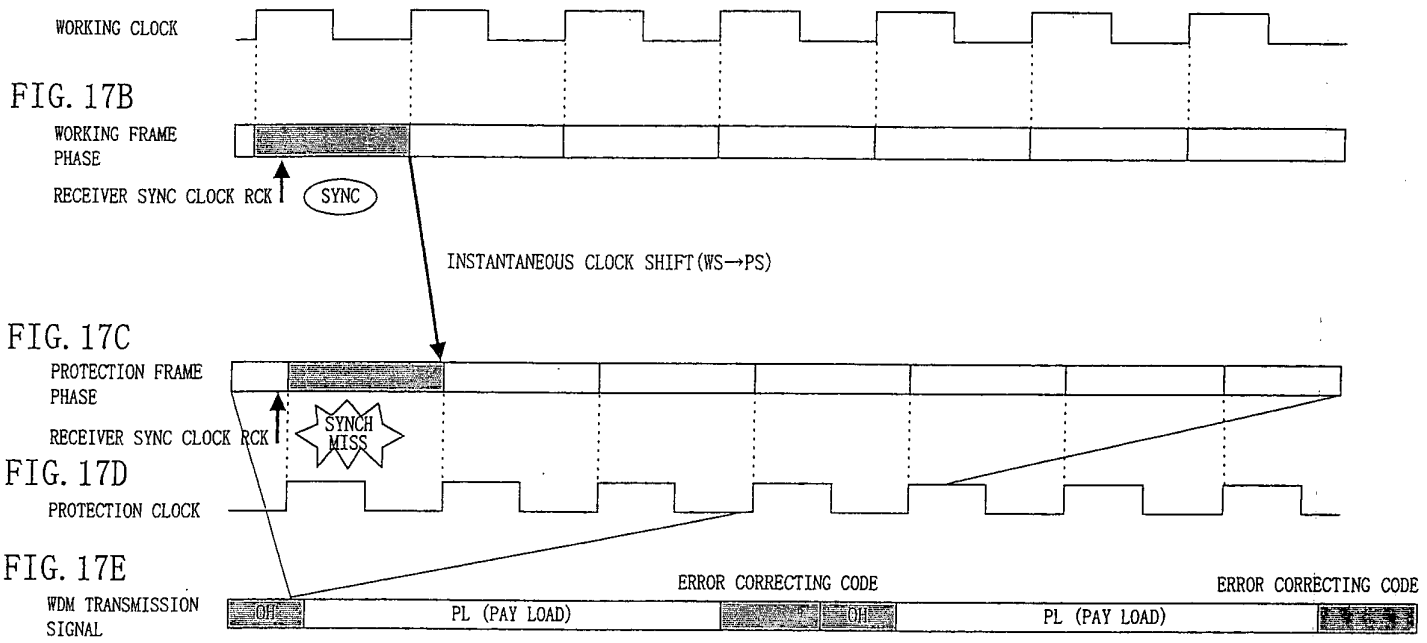
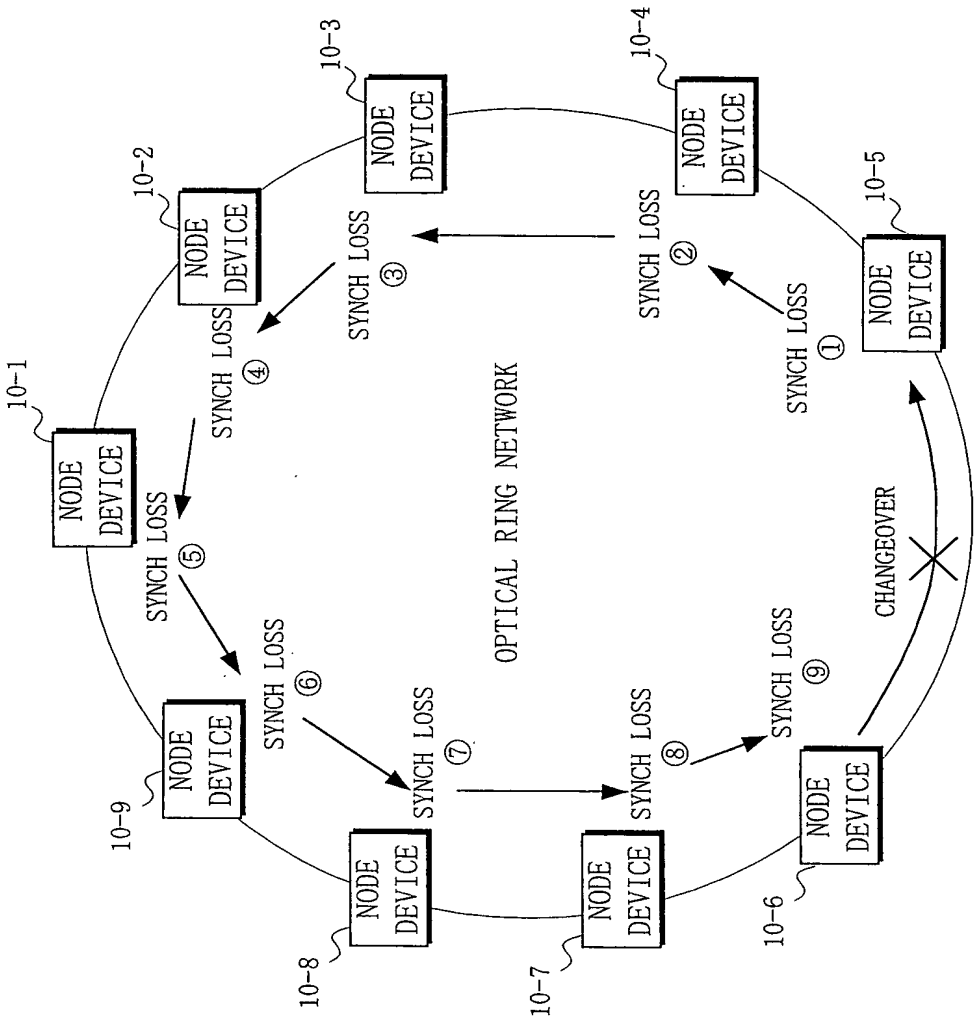


FIG. 18


NODE DEVICE
10-1
10-2
10-3
10-4
10-5
10-6
10-7
10-8
10-9
SYNCH LOSS ①
SYNCH LOSS ②
SYNCH LOSS ③
SYNCH LOSS ④
SYNCH LOSS ⑤
SYNCH LOSS ⑥
SYNCH LOSS ⑦
SYNCH LOSS ⑧
SYNCH LOSS ⑨
OPTICAL RING NETWORK
CHANGEOVER